PERFORMANCE VERIFICATION PLAN
VERSION 2.0

**TARGETED DEMAND MANAGEMENT
PERFORMANCE VERIFICATION FOR
NON-WIRES SOLUTIONS PROGRAM
DISTRIBUTED GENERATION AND ENERGY STORAGE RESOURCES**

May 2022

INTRODUCTION

This Performance Verification Plan describes the approach to calculate and verify performance for energy storage (ES) and distributed generation (DG) projects as part of Non-Wires Solutions programs, including but not limited to combined heat and power (CHP), fuel cell, and battery energy storage system (BESS) technologies. This performance verification plan is applicable to eligible NWS projects installed in year 2022 and beyond.

This plan contains:
- Measurement and Verification Requirements – outlines measurement, data, and verification for participating projects
- Performance Assessment – outlines how performance will be assessed for:
    o Distributed Generation during the Summer Performance Period
    o Distributed Generation during NWS Event Days
    o Underperformance for Distributed Generation during NWS Event Days
    o Energy Storage during NWS Event Days

A monitoring system shall be installed to measure and collect the data necessary to quantify the electric power produced by the DG equipment or the charging and discharging patterns of the BESS equipment. The data will serve as the basis for performance assessments and payments. Depending on the specific nature of individual projects and technologies, revisions may be required to accurately quantify demand reduction impacts.

MEASUREMENT AND VERIFICATION REQUIREMENTS

The following subsections outline the measurement and data needs to assess DG and BESS project performance.

Measurement Requirements

Following an internal desk review of the project, Con Edison or its Measurement & Verification (M&V) vendor(s) will develop a project-specific M&V Plan. The M&V Plan will specify the measurement and any metering requirements for the NWS project. In the event the M&V Plan requires additional metering beyond the Applicant's proposal, Con Edison or its M&V vendors may request and install additional meters. The Applicant shall provide access to equipment and electrical panels to the M&V vendor as necessary for the deployment of measurement instruments.

Data Requirements

The Applicant shall provide Con Edison or its M&V vendor(s) direct access to real-time data over a web interface. The metering and data collection shall be granted to Con Edison or its M&V vendor(s) from the commercial operation date until the end of the contract term specified in the NWS Energy Storage Program Agreement, NWS Program Agreement, or other applicable Con Edison contract.

Required trend points shall include, but not be limited to:
- Real power (kW) production

- Voltage

- Amperage

- Power factor

- Natural gas or any other fuel consumed (if applicable)

- Heat recovered (if applicable)

- Parasitic loads
- Net power import/export from the system and grid

To confirm the accuracy of the trended electricity production, Con Edison or its M&V vendor may also deploy supplemental power meters. Field engineers may deploy real power meter(s) (current transformers), of varying size and quantity based on the DG or BESS system specifications, at the power disconnect of the targeted component(s). Real power will be metered for a representative period in order to retrieve sufficient data to verify system performance. The M&V vendor will require customer approval to access the site to verify conditions, observe functional testing, and install metering equipment as deemed appropriate and as defined by the project-specific M&V plan.

The M&V vendor will also investigate any parasitic loads (e.g., fuel booster pumps) related to the DG or BESS component(s) of the system that may impact facility electric consumption. Oftentimes, comprehensive data tracking systems already account for parasitic loads associated with the system and truly reflect the electricity displaced from the grid. If not, the M&V vendor may need to collect additional data or perform supplemental monitoring to accurately determine parasitic loads.

For DG and BESS projects, construction-grade design drawings or "As Built" drawings shall be provided to the M&V vendor, as they become available.

Verification Requirements
The M&V vendor might perform on-site inspections and data collection at the time of project commissioning to confirm that the DG or BESS system is operating as planned. Additional verification activities may include review of documentation for existing and as-built conditions, as well as observation of functional testing and operational sequence activities required to demonstrate the ability to provide the anticipated demand reduction. These additional activities may or may not be conducted simultaneously to any commissioning activities being performed by others. This initial data collection will inform future incentive payment(s) by Con Edison.

PERFORMANCE ASSESSMENT

The M&V vendor's main objective is to assess the hourly grid electricity offset of the proposed DG or BESS system during the Summer Performance Period (May 1st through September 30th).

The M&V vendor will aim to confirm 1) a reduction in the grid-supplied electricity to the facility and 2) that this reduction is due to the newly installed DG or BESS system. Electric consumption, billing, and/or interval meter data from the summer before participation may be needed to identify shifts in the facility's electric load profile.

Con Edison reserves the right to request data throughout the entire program period, including shoulder or winter seasons, as needed, to determine the full impact of the project on the grid. Periods outside of the performance assessment period will not be used to determine incentives unless otherwise stated.

The following subsections detail the calculations used to derive Performance Factors (PF).

Distributed Generation (Summer Performance Period)
The Summer Performance Period is defined as:
- Weekdays, May 1st through September 30th of the performance year, defined as the peak summer electric load months in Con Edison's service territory.

- The Network Overload Period hours identified in the NWS Program Agreement. These hours within this Period are considered the peak summer electric load hours for the respective NWS project.

Using this data set, Con Edison and the M&V vendor will analyze the performance of DG system components. The DG Performance Calculation section is not applicable for BESS technologies.

The Average Load Reduction Performance (ALRP) is calculated based on the following formula:

$$ALRP = \frac{\sum_{i=0}^{n} kWh_i}{n}$$

Where,

kWh_i	Electricity generated per hour interval i
i	Each hourly interval during Summer Performance Period
n	Total number of qualified hours in the Network Overload Period

The hourly measurements are a result of aggregated 15-minute interval readings. The bottom 5% of kWh_i collected during Summer Performance Period will be excluded from this calculation. If Con Edison is unable to provide electric service to the Customer at any time during the Performance Period, those hours will be excluded from this calculation and made note of in the evaluation report.

For the Summer Performance Period, any missing data points will be replaced with assumed kWh_i of 0. Any remaining data points which captured maintenance or unexpected downtimes will be included in the performance extrapolation of the DG system.

The Performance Factor (PF_{Summer}) for the Summer Performance Period is calculated as follows:

$$PF_{Summer} = \frac{ALRP}{Pledge}$$

Where,

Pledge   Demand Reduction guaranteed in NWS Program Agreement

The program Participants are bound by the rules in the NWS Program Agreement. The PF_{summer} will be used to calculate performance-based incentives, as outlined in the Agreement. On NWS Event Days, these DG Participants are expected to perform at 100% during the Network Overload Period hours specified in the NWS Program Agreement.

Distributed Generation (NWS Event)

The NWS Event will occur on dates when a Commercial System Relief Program (CSRP) or Distribution Load Relief Program (DLRP) event[1] is called for the network during the defined Summer Performance Period:

- May 1st through September 30th of the performance year

- May occur during weekends and holidays

- For DG technologies, the call window is the Network Overload Period hours identified in the NWS Program Agreement.

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[1] See the Commercial Demand Response (Rider T) Program Guidelines for more information on Commercial System Relief Program (CSRP) and Distribution Load Relief Program (DLRP) events.

To determine the Performance Factor, Con Edison or its M&V vendor will average hourly performance for each event and divide the result by the Pledge (i.e. NWS Program Agreement Load Reduction Guaranty). Underperformance penalties will be exercised as described in the NWS Program Agreement, Underperformance sub-section. The NWS Event – Performance Factor calculation below is applicable to DG technologies, not including BESS.

The Average Event Load Reduction (AELR) per event is calculated based on the following formula:

$$AELR = \frac{\sum_{i=0}^{n} kWh_i}{n}$$

Where,

kWh_i	Electricity generated per hour interval i
i	Each hourly interval during NWS Event
n	Total hours in the Network Overload Period

The Performance Factor (PF_{Event}) is determined for each NWS Event during the Summer Performance Period and is calculated as follows:

$$PF_{Event} = \frac{AELR}{Pledge}$$

Where,

AELR	Average Event Load Reduction for the NWS Event
Pledge	Demand Reduction guaranteed in NWS Program Agreement

Underperformance (Distributed Generation NWS Event)

For distributed generation, underperformance will be determined for each NWS Event as the difference between the Pledge and the AELR for an NWS Event Performance Factor (PF_{Event}) less than 90%.

The Underperformance (U_{Event}) is determined for each NWS Event during the Summer Performance Period and is calculated as follows:

For any $PF_{Event} < 90\%$:

$$U_{Event} = Pledge - AELR$$

Where,

AELR	Average Event Load Reduction for the NWS Event
Pledge	Demand Reduction guaranteed in NWS Program Agreement.

Liquidated Damages are applied against Underperformance (U_{Event}) during an NWS Event as described in the Underperformance sub-section in the NWS Program Agreement.

Please refer to the appropriate NWS Program Agreement for information on payment calculations, including application of Liquidated Damages and any non-payment as a result of the DG resources failure to meet minimum performance requirements.

Energy Storage (NWS Event)

For energy storage technologies that are participating in the NWS program, the technology may not charge during the specified Network Overload Period on NWS Event Days or Restricted Charging Days from May 1st to September 30th, inclusive.

NWS Events may be called during the defined Summer Performance Period:
- May 1st through September 30th of the performance year

- NWS Events are defined as Con Edison's request, with no less than 21 hours advance notice, for load reduction during the call window

- NWS Events will be called for a minimum of 4-hour consecutive period[2], based on need, with event start and end time specified at the beginning of each Summer Performance Period and/or in the NWS Event call notification

The calculations in this section are applicable to BESS, not DG technologies.

For BESS that are participating in NWS, the technology may not charge within the Network Overload Period on NWS Event Days from May 1st to September 30th, inclusive. If on NWS Event Days, charging occurs outside of event hours and within the overload period, an adjustment will be calculated per the Energy Charged on Event Days (EC_M) formula below. This adjustment will be incorporated into the Average Event Load Reduction (AELR) calculation as a deduction of the load relief provided during the days NWS Event hours where applicable.

The Energy Charged during Event Days (EC_M) in kW on an NWS Event Day during non-event hours within the restricted charging window is calculated based on the following formula:

$$EC_M = \frac{\sum_{t=E_{start}}^{t=R_{start}} kWh_t + \sum_{t=R_{end}}^{t=E_{end}} kWh_t}{(R_{end} - R_{start}) - (E_{end} - E_{start})}$$

Where,

kWh_t	Energy charged at energy storage meter per hour interval t (charging will result in negative kWh values, discharging will result in kWh set to zero)
t	Each non-event hourly interval within the network overload period on NWS Event Days
E_{start}	Event start time (hour starting)
E_{end}	Event end time (hour ending)
R_{start}	Network overload period start time (hour starting)
R_{end}	Network overload period end time (hour ending)
M	NWS Event Day

If EC_M calculated value is positive, EC_M will assume the value of 0. Any missing or incomplete data points will be replaced with assumed kWh_t of 0. Any data points which captured maintenance or unexpected downtimes will be included in the EC_M calculation.

To determine the AELR on an NWS Event Day, the battery energy storage system discharge in kWh is measured across the applicable NWS Event hours, then divided by the number of hours within the event call window to determine average hourly system discharge. The EC_M adjustment is then incorporated where applicable.

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[2] Changes to length of call window will be communicated by the company, where the Project may be expected to deliver the equivalent kWh over an adjusted duration at an adjusted capacity, as identified in the NWS Energy Storage Program Agreement

The Average Event Load Reduction (AELR) is calculated based on the following formula:

$$AELR_M = \left(\frac{\sum_{i=E_{start}}^{i=E_{end}} kWh_i}{E_{end} - E_{start}}\right) + EC_M$$

Where,

kWh_i	Electricity discharged per hour interval i (charging will result in negative kWh values)
i	Each hourly interval during NWS Event
M	NWS Event Day
EC_M	Energy Charged on Event Days

Any missing or incomplete data points will be replaced with assumed kWh_i of 0. Any data points which captured maintenance or unexpected downtimes will be included in the AELR calculation.

To determine the Performance Factor for each NWS Event Day, Con Edison or its M&V vendor will divide the AELR for each event by customer load reduction guaranty.

The Performance Factor ($PF_{Event\ M}$) is determined for each NWS Event during the Summer Performance Period and is calculated as follows:

$$PF_{Event\ M} = \frac{AELR_M}{Guaranty}$$

Where,

$AELR_M$	Average Event Load Reduction for NWS Event M
M	NWS Event Day
Guaranty	Load reduction guaranteed in NWS Energy Storage ProgramAgreement

The expectation of system performance is that the BESS discharges at a minimum of 90% pledged capacity for the duration of each NWS Event. This performance threshold will be used to adjust each event's performance factor in the case that the system does not meet this expectation.

The Adjusted Performance Factor for each NWS Event is calculated as follows:

$$PF_{Adjusted\ Event\ M^3} =$$

If $\quad PF_{Event\ M} \geq Performance\ Target\ Threshold^4$
Then $\quad PF_{Adjusted\ Event\ M} = PF_{Event\ M}$
If $\quad PF_{Event\ M} < Performance\ Target\ Threshold$
Then $\quad PF_{Adjusted\ Event\ M} = PF_{Event\ M} - (Performance\ Target\ Threshold - PF_{Event\ M})$

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[3] If Adjusted Performance Factor < -0.90, then Adjusted Performance Factor = -0.90
[4] Performance Target Threshold is set at 0.90

The adjusted performance factors for each NWS Event will be averaged to provide the performance factor for the entire Summer Performance Period. This factor will be included in the final payment calculation.

The NWS Season Performance Factor is calculated as follows:

$$NWS\ Season\ Performance\ Factor = \frac{\sum PF_{Adjusted\ Event\ M}}{Total\ Number\ of\ Events}$$

Energy Storage (Restricted Charging Days)
For BESS that are participating in NWS, the technology may not charge within the Network Overload Period on Company identified Restricted Charging Days from May 1st to September 30th, inclusive.

Restricted Charging Days may be called during the above defined Summer Performance Period:

- Restricted Charging Days are defined as Con Edison's request, with no less than 21 hours advance notice, that the technology may not charge during the identified Network Overload Period[5]

- For BESS technologies, charging is restricted[6] to outside of the Network Overload Period

- The project is not obligated under the NWS Energy Storage Program Agreement to discharge on Restricted Charging Days, subsequent discharging will not impact the Performance Payment for the Summer Performance Period

If on these Restricted Charging Days, charging occurs, a deduction will be calculated per the Restricted Charging Deduction formula below and incorporated against the Performance Payment at the end of the Summer Performance Period. Any missing or incomplete data points will be replaced with assumed kWh_t of 0. The calculations in this section are applicable to BESS, not DG technologies.

The Restricted Charging Deduction is calculated as follows:

$$Restricted\ Charging\ Deduction = \sum_{t=R_{start}}^{t=R_{end}} kWh_t * K$$

Where,

kWh_t	Energy charged at energy storage meter per hour interval t (charging will result in positive kWh values, discharging will result in kWh set to zero)
t	Each hourly interval within the restricted charging window (hour ending)
R_{start}	Network overload period start time (hour starting)
R_{end}	Network overload period end time (hour ending)
K	Applicable Charging Deduction Rate ($/kWh) (refer to program documents)

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[5] The Network Overload Period is specified in the NWS Energy Storage Program Agreement. Any adjustment to this overload period will be communicated prior to the Summer Performance Period
[6] The project shall adhere to restrictions as identified by the Company in the projects CESIR study or other project documentation

The Performance Payment for each Summer Performance Period will be based on 5% of the overall project incentive over the 10-year duration of the contract[7]. The preceding performance calculations will be applied to the performance periods incentive, resulting in the eligible Performance Payment.

The Performance Payment for each Summer Performance Period will be calculated as follows:

$$Performance\ Payment$$
$$= (Incentive\ {}^\$\!/_{kW} * Guaranty * NWS\ Season\ Performance\ Factor * 5\%)$$
$$- Restricted\ Charging\ Deduction$$

If the Performance Payment calculation results in a negative value (i.e. the NWS Participant owes the Company payment), refer to the NWS Energy Storage Program Agreement "Calculations of Performance Payments" section.

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[7] Refer to NWS Energy Storage Program Agreement for incentive payment schedule